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REVIEW OF NATIONAL DATA PROCESSING CAPABILITIES IN AFRICA

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I. INTRODUCTION

1. This report presents the results of the sixth biennial regional survey of electronic data processing (EDP) capabilities and requirements. The survey was conducted over the period of 31 January to 31 August 1983. It covered all known statistical and EDP organizational units in Africa and, like its predecessors inquired into the related hardware and software facilities, equipment utilization, EDP personnel, and EDP staff development, and an evaluation of the EDP equipment. In addition, it sought also to establish a directory of EDP experts in the African region with a view to assessing technical assistance possibilities among countries of the region.

2. The questionnaires were addressed to 318 organizational units in 50 developing African countries. Replies were received from only 118 respondents in 33 countries as shown in table 1. The responses being far from comprehensive, indirect means such as mission reports1/ of EDP experts in African countries, responses of EDP equipment suppliers 2/ to a simplified questionnaire, and the 1981 EDP survey report were also used to fill gaps whenever possible.

3. The analysis of the results of the 1983 survey takes into account the 1981 EDP survey report for only central processing units. They must therefore be interpreted with care.

Table 1. Responses to questionnaire

Sub-region	Countries 3/ QS 4/	RR 5/	% 6/	National Statistical Offices (NSO) QS	RR	%	Other EDP Organizational Units QS	RR	%	All Organizational Units QS	RR	%
North Africa	6	2	33	6	2	33	18	-	-	24	2	8
West Africa	16	9	56	16	8	50	105	28	27	121	36	30
Central Africa	10	6	60	10	3	30	24	8	33	34	11	32
Eastern and Southern Africa	18	16	89	18	15	83	121	54	38	139	69	50
TOTAL	50	33	66	50	28	56	268	90	34	318	118	37

4. The information obtained from the survey is presented in the provisional Directory of EDP centres (E/ECA/PSD.3/42) and in the Directory of EDP specialists (E/ECA/PSD.3/41). The tables contained in the report summarize information from the two documents. However there will be slight discrepancies between the figures contained in this report and those in the above documents which will be updated before presentation to the Joint Conference.

1/ For the following countries: Angola, Cape Verde, Congo, Ivory Coast, Mauritania, Sao Tome, Sudan, Uganda and Zaire.
2/ For the following countries: Angola, Chad, Guinea and Seychelles
3/ Countries which returned at least one questionnaire.
4/ QS = Questionnaire sent.
5/ RR = Questionnaire returned.
6/ Percentage of response rate.

II. HARDWARE AND SOFTWARE FACILITIES IN AFRICA

5. The survey inquired into the number, make and model of the central processing units available in Africa, their primary memory size, operating systems, date of acquisition as well as the nature of the tenure. It aimed also at obtaining information on characteristics of input-output devices, a description of the software facilities and an indication of the frequency of their use. Particulars were also sought on planned acquisition of additional or alternative hardware and software.

(a) Central processing units

6. The data shown in table 2 below which are available for 43 countries, may not reflect the correct distribution (absolute or percentage) of central processing units between sub-regions. This is because the number of agencies, for which information is available, is not necessarily exhaustive in respect of any country. However the data give the lower bound for the number of electronic data processing equipment being used in the region.

7. IBM was the predominant supplier of equipment with 28 per cent of the total number of computers. It was followed by ICL (15 per cent), NCR (13 per cent) and CII-HB (11 per cent). These four makes together accounted for 67 per cent of the total number of computers in use in Africa.

8. IBM was most popular in West Africa as opposed to ICL in Eastern and Southern Africa. It must be noted that at least 11 IBM computers were replaced in 1983 in West Africa by WANG's. 7/

Table 2. Estimated number of computers by make and by sub-region in 43 African countries, 1983

Make	North Africa S 8/	North Africa NS 9/	North Africa T	West Africa S	West Africa NS	West Africa T	Central Africa S	Central Africa NS	Central Africa T	Eastern and Southern Africa S	Eastern and Southern Africa NS	Eastern and Southern Africa T	Developing Africa S	Developing Africa NS	Developing Africa T
IBM	1	42	43	15	54	69	19	12	31	22	22	44	57	130	187
ICL	-	-	-	2	6	8	-	-	-	35	57	92	37	63	100
NCR	-	-	-	8	6	14	33	2	35	7	31	38	48	39	87
CII-HB	2	45	47	7	15	22	4	1	5	2	2	4	15	63	78
OLIVETTI	-	-	-	9	28	37	-	2	2	3	-	3	12	30	42
BURROUGHS	-	23	23	-	10	10	-	-	-	5	3	8	5	36	41
WANG	-	-	-	17	3	20	-	-	-	5	6	11	22	9	31
HEWLETT-PACKARD	-	3	3	3	-	3	4	1	5	4	2	6	11	6	17
OTHER MAKES	-	36	36	10	10	20	13	-	13	12	16	28	35	62	97
TOTAL	3	149 10/	152	71	132	203	73	18	91	25	139	234	242	438	680

9. The number of central processing units available in North Africa was definitely underestimated due to the fact that only two organizations in two countries 11/ returned the questionnaire. The data for Algeria was obtained from the document Situation de l'informatique en Algérie au 1er janiver 1982 published by the National Statistical Office. In the 1983 survey, a respondent from Morocco estimated the number of computers available in that country as at least 150.

7/ of which nine were for use in Ghana. 8/ S = Data from the 1983 survey. 9/ NS = Non-survey data obtained from mission reports of EDP experts in African countries and also from the 1981 survey report. 10/ Data for Algeria only as at 1 January 1982. 11/ Direction de la

10. Information on the primary memory size was provided for 140 organizational units. Approximately 21 per cent of the computers had a primary memory size less than 100 K-bytes. The median primary memory size was between 100 K-bytes and 200 K-bytes. The primary memory size of computers equalled or exceeded 2 megabytes in 12 organizations[12] as opposed to 4 in the last survey. The tendency to acquire more powerful computers which was observed in the last survey is therefore confirmed.

Table 3. Acquisition date and primary memory size (K-bytes) of central processing units in Africa, 1983

Primary Memory Size \ Acquisition date	1965-1974	1975-1979	1980	1981	1982	1983	Not stated	Planned	Total
Less than 30	15	9	2	1	-	1	10	-	36
30-49	5	9	4	4	1	-	23	-	46
50-99	7	11	5	6	7	-	25	-	59
100-299	5	20	12	9	10	5	37	1	99
300-599	4	2	3	3	2	3	10	1	28
600-999	-	-	1	3	2	1	-	-	7
1000-1999	1	3	2	1	5	5	1	-	18
2000 and over	-	-	2	1	4	2	2	1	12
Not stated	-	2	-	-	5	9	359	-	375
TOTAL	35	56	31	28	36	26	467	3	680

11. Of the 199 central processing units for which relevant information is available, 68 per cent was owned. In spite of the great number of the organizational units which did not state the types of tenure of their equipment, the figures indicate that generally organizations prefer to own rather than rent their computers.

Table 4. Acquisition date and type of tenure of central processing units in 43 African countries, 1983

Type of Tenure \ Acquisition date	1965-1974	1975-1979	1980	1981	1982	1983	Not stated	Planned	Total
Owned	19	35	18	18	20	12	12	3	136
Rented	10	19	10	8	7	6	3	-	63
Not stated	6	2	3	2	9	8	454	-	481
TOTAL	35	56	31	28	36	26	467	3	680

12/ Office central de mécanographie (Ivory Coast) 2 MB; Direction du traitement automatique de l'information (Senegal) 2MB and 8MB; Centre national de la statistique et des études économiques (Congo) 2MB; Gabon Informatique (Gabon) MB; SOZACOD (Zaire) 2 MB; Botswana Government Computer Bureau (Botswana) 3.5 MB; United Nations Economic Commission for Africa (Ethiopia) 2 MB; Caltex Oil (Ye ya)

12. Only fifteen organizations stated the reasons for ordering additional central processing units. The reasons stated were as follows: acquisition of more powerful equipment (7 organizations), new applications (6 organizations), replacement of old equipment (2 organizations).

13. Eighty one organizations had central processing units which were located in their organizational units. The number of interactive work stations of the 48 EDP organizational units in respect of which information is available ranged from 1 to 64 with an average of 11 units.

(b) Input-output devices

14. Respondents were asked to furnish information on input-output devices as regards the device type, the make and model, the characteristics, the number of units presently used or ordered by type of tenure.

15. Information on the peripheral devices was provided by 93 organizational units. There were 1642 input-output devices in use of which 56 per cent were owned. An additional 318 devices were reported to be on order.

16. ICL was the predominent supplier of the devices in use with 34 per cent, followed by IBM (26 per cent); HP (12 per cent); CII-HB (10 per cent); NCR (6 per cent) and WANG (5 per cent).

17. Card devices were available in 57 per cent of the reporting organizational units. They represented only 8 per cent of the total number of these devices. Paper tape equipment accounting for only 2 per cent is out of date.

18. Magnetic storage was used in 91 per cent of the organizational units, accounting for 38 per cent of the number of peripheral devices. Diskette equipment, magnetic disc units, magnetic tape units and direct data entry accounted for 14 per cent, 12 per cent, 7 per cent and 5 per cent of all these devices respectively.

19. Printing equipment was in use in 84 per cent of the organizational units for which information is available. Line printers were reported in 71 per cent of the organizational units whereas train printers, graph plotters and band printers were said to be used in 11 per cent and 2 per cent respectively. Matrix printers were also reported in 4 per cent of these organizational units.

20. Video display/terminals were available in 55 per cent of the organizational units, representing 25 per cent of the input-output devices. Modems were reported in 7 per cent of the organizational units, accounting for 5 per cent of the total number of all the peripheral devices.

Table 5. Number of input-output devices by make and device type in 93 organizational units

Make \ Device type	Card	Paper Tape	Direct Data Entry	Disk-ette	Magn-etic Disc Unit	Magn-etic Tape Unit	Line Printer	Train Printer	Graph Plot-ter	Video Dis-play Unit/ term-inal	Mo-dem	Other	Total
ICL	69	7	36	9	77	59	42	4	-	115	37	103	558
IBM	91	13	12	150	45	24	23	10	-	53	10	33	424
HP	1	-	22	-	19	5	15	-	4	89	-	36	191
CII-HB	3	-	-	46	13	8	3	-	-	59	18	3	159
NCR	4	2	-	-	11	7	8	2	-	21	2	2	94
WANG	-	-	6	4	11	3	6	-	-	54	2	37	88
OTHER	10	6	-	26	26	1	18	1	1	18	16	11	128
TOTAL	138	28	76	235	202	107	115	17	5	409	85	225	1 642

(c) Software

21. The particulars sought on software concerned the name, description of compilers, assemblers and packages used in the region as well as the frequency of their use. Information on whether such software was already available for use to the organizational units or whether it had only been ordered was also sought.

22. Information was provided by 108 organizational units in 41 countries. Sixty three per cent of these organizational units use multiprogramming. COBOL was the language most used. It was reported to be used in 66 per cent of the organizational units and very extensively in 53 per cent. Then FORTRAN, RPG, ASSEMBLY, BASIC followed with 36 per cent, 33 per cent, 27 per cent and 25 per cent respectively. PL1 was reported for 8 organizational units, PLAN for 5, PASCAL for 4, ALGOL for 2, SPL and NEAR for 1 each.

23. Apart the normal utility programmes provided with computers, specific packages were reported for very few organizations. CONCENTS was said to be used in 11 organizational units, CONCOR in 9, SPSS in 8, CENTS in 6, RGSP, ARIEL, TSP, GENSTAT, X-TALLY and REGRES in 2 each. Most of private commercial agencies used financial packages such as PAYROLL, PROSPER, etc. for payroll, sales, investment analysis, and billing.

24. Data base management systems were reported for 12 organizational units of which 4 statistical organizations. 13/ These data base management systems were RAPID, IMAGE 1000, IMAGE 3000, TOTAL, MDMS, DLI, QUERY 45. Two data base management systems were reported to be of order. Only 3 data base management systems were started to be used extensively. 14/

13/ Centre national de la statistique et des études économiques - Congo (IMAGE 3000); Institut national de la statistique et de la démographie Haute Volta (RAPID), Central Statistical Office - Ethiopia (IMAGE 3000) and United Nations Economic Commission for Africa - Ethiopia (IMAGE 3000).

14/ DLI for Bong Mining Company (Liberia); TOTAL for Caltex Oil Ltd. (Kenya); IMAGE 3000 for Ethiopian Airlines, and United Nations Economic Commission for Africa (Ethiopia).

III. EQUIPMENT UTILIZATION

25. Information was sought on the various electronic data processing tasks undertaken or planned. These were classified by statistical and other types of tasks identifying separately population census, foreign trade, manpower, household survey, payroll, accounting, training and other activities. Respondents were also requested to furnish particulars on the average number of minutes performed per day, the percentage of total processing time, number of records on storage for the present applications, and commencement date as well as estimated number of records for future applications. The number and length of shifts were also requested in respect of data entry and computer operations.

26. Only 73 organizational units in 26 countries furnished information on their electronic data processing tasks and computer workload. Of these only 25 organizations were engaged on statistical work.

27. The computer time spent on statistical jobs varied enormously between organizations and countries. It ranged from 20 to 1260 minutes per day and was estimated to average 303 minutes per day. In the countries where work on population census was in progress such an activity absorbed the greatest amount of processing time, otherwise generally foreign trade, household surveys, labour statistics in that order accounted for the greatest workload on the computer. Among other tasks reported were agricultural, demographic, industrial and price statistics.

28. Training activities were reported for only 16 organizational units and the computer time devoted to them is estimated to average 125 minutes per day. This time exceeded the average for those organizational units which were formal training centres or have important in-house electronic data processing training activities.

29. Non-statistical work undertaken related mainly to payroll, accountancy and banking. Some organizations reported applications to automatic billing and stock control, sales and investment analysis. Software development was reported by only four organizational units. Computer time for non-statistical work ranged from 27 to 1406 minutes per day and was estimated to average 367 minutes per day. Most of computer time was therefore spent on non-statistical work in the region.

30. The eight-hour single shift was prevalent both in respect of data entry and computer operations staff. It represented approximately 56 per cent and 47 per cent respectively of the total number of shifts observed.

Table 6. Number and length of shifts operated in 83 organizational units in respect of data entry and computer operations staff, 1983

Number of shifts	Length (hours) 3	4	5	6	7	8	9	10	12
Data entry									
1 shift	-	-	-	2	7	34	4	1	-
2 shifts	-	1	1	7	9	9	-	-	-
3 shifts	-	-	-	2	-	1	-	-	-
4 shifts	-	1	-	-	-	-	-	-	-
Sub-total	-	2	1	11	16	44	4	1	-

Table 6. Number and length of shifts operated in 83 organizational units in respect of data entry and computer operations staff, 1983 (cont'd)

Number of shifts	Length (hours) 3	4	5	6	7	8	9	10	12
Computer operations									
1 shift	1	-	-	4	5	18	3	3	1
2 shifts	-	1	-	5	10	13	-	1	-
3 shifts	-	-	1	1	2	4	-	-	-
4 shifts	-	-	-	2	-	-	-	-	-
Sub-total	1	1	1	12	17	35	3	4	1

IV. PERSONNEL

31. Particulars were asked on electronic data processing staff and plan for future recruitment. The main categories of staff as well as those with a statistical background were listed separately. An attempt was also made to find out the reason for planned recruitment and the expected length of service.

32. The number of electronic data processing staff was 2112 for the 89 organizational units for which data is available. Of these 29 per cent of the personnel were engaged in systems and programming, 18 per cent for computer operations and 43 per cent for data entry. Sixty five of the organizational units had systems managers, 45 per cent of whom were reported to have statistical background. On the other hand only 14 per cent of the other systems and programming staff were said to have statistical background.

Table 7. Existing EDP personnel in 89 organizational units

Category of staff	Total EDP staff	EDP staff with statistical background
A. Systems and programming staff		
Manager	75	34
Systems analyst	104	23
Analyst programmer	134	22
Software programmer	44	2
Programmer (applications)	263	29
Sub-total A	620	110
B. Computer operations staff		
Manager	51	3
Operator	337	5
Sub-total B	388	8
C. Data entry staff		
Supervisor	99	-
Operator	727	4
Other	79	-
Sub-total C	905	4
D. Off-line operations	199	-
TOTAL (A+B+C+D)	2112	112

33. Only 15 organizational units in respect of which information is available stated to have software programmers. Systems analysts and analysts/programmers were employed in 39 and 51 organizational units respectively. Thirteen of the organizational units did not have programmers at all.

34. Of the 134 electronic data processing personnel planned for recruitment 75 per cent were for systems and programming, 15 per cent for computer operations, and 9 per cent for data entry. Thus these recruitment plans confirm the demand for systems and programming staff in the region. Among the reason most frequently stated for planned recruitment were new applications, staff turnover, lack of staff, staff's skill improvement and change of electronic data processing equipment in that order. The new personnel expected were being recruited on a permanent basis.

Table 8. Recruitment plans for EDP personnel in Africa

Category of staff	Number of organizations with plans for recruitment	Planned number of recruits
Systems and programming staff		
Manager	4	5
Systems analyst	8	15
Analyst/Programmer	14	21
Software programmer	3	8
Programmer (applications)	18	51
Other staff		
Computer operations	7	20
Data entry	6	12
Other	2	2

V. TRAINING

35. Information was sought on current and future training of electronic data processing staff by the type of training, and its location, and number of staff expected to undertake EDP training during the 1984-1987 period distinguishing between the following types of training: general EDP, programming and systems.

36. In 1983, 434 staff members of the organizational units in respect of which information is available were in training. Approximately 91 per cent of the personnel were trained within the reporting countries and 58 per cent of these trainees at commercial centres. Systems and programming personnel represented 63 per cent of the total number of trainees, reflecting the great demand for that type of personnel.

Table 9. EDP staff in training from 42 organizational units classified by location and type of training, 1983

Type of training / Location	A. In own country				B. Elsewhere			
	Govt.	Commercial Centre	Other	Sub-total (A)	In Africa	Elsewhere	Sub-total	Total (A+B)
Systems training	18	65	18	101	2	15	17	118
General programming	16	94	16	126	1	5	6	132
Software programming	2	14	4	20	3	1	4	24
Computer operation	7	46	29	82	4	-	4	86
Data preparation	3	24	27	54	-	-	-	54
Other	-	8	5	13	-	7	7	20
TOTAL	46	251	99	396	10	28	38	434

37. Table 10 shows a very strong demand for high-level language processing staff as well as an equally strong demand for systems personnel. COBOL programming trainees accounted for 59 per cent of the total number of programming trainees in 1984, 72 per cent in 1985, 1986 and 1987.

Table 10. EDP training plans for 51 organizational units in 20 African countries, 1984-1987

Type of training	1984	1985	1986	1987
General EDP				
Introductory	66	61	73	74
Intermediate	32	41	42	43
Advanced	51	31	36	39
Programming				
COBOL	130	117	134	150
Intermediate	30	23	32	35
FORTRAN	39	22	18	19
RPG	5		-	-
Other	16 15/	1 16/	-	-
Systems training				
Introductory	31	30	45	51
Intermediate	35	46	41	44
Advanced	19	36	18	23
Other	10	15	13	9

15/ Ten trainees for TDC, 4 for PLAN and 2 for PASCAL.

16/ For PASCAL.

38. Twenty seven formal EDP training facilities were identified. Most of the training was however conducted in-service or at centres provided by EDP suppliers or other commercial organizations within the country.

VI. EVALUATION OF EDP EQUIPMENT

39. An evaluation of the equipment used by EDP organizational units was to be made based on the following criteria, (a) provision of staff training, b) provision of repair service (c) availability of consultants/experts, (d) extent of software support, (e) ease of lateral and upward conversion, (f) suitability or adequacy for statistics, (g) down time (out of order) condition.

40. This evaluation was made by 76 organizational units 19 of which were performing statistical work. Concerning the criteria used for the evaluation of equipment, the percentage of users in respect of all makes who found it good or excellent was as follows: provision of repair service (85 per cent), down time condition (68 per cent), provision of staff training (68 per cent), extent of software support (50 per cent), ease of lateral and upward conversion (47 per cent), availability of consultants or experts (45 per cent) and suitability or adequacy for statistics (40 per cent).

41. Generally the down time condition of equipment was rated the most important of the considerations in respect of all makes. Provision of repair service, provision of staff training, extent of software support, availability of consultants or experts, ease of lateral and upward conversion, and suitability or adequacy for statistics were rated in that order of importance.

VII. MISCELLANEOUS

(a) Particulars on other organizations in the country of the reporting organization

42. Respondents were requested to provide information relating to the availability of computers in other organizations in the country in addition to particulars on their own organizations. These particulars concerned the name, address of these organizational units, make, model and primary memory size of the central processing units used by them. The information sought aimed, among other things, at completing the list of African EDP organizational units for other EDP surveys. Sixty six organizational units in 21 countries furnished such information. Unfortunately this is not comprehensive enough to form the basis of a full directory of EDP centres. Thus, the document prepared (E/ECA/PSD.3/42) is to be considered as provisional only.

(b) Particulars on EDP centres performing government statistical work

43. Particulars were available for 45 organizational units performing government statistical work. Twenty one African national statistical offices had central processing units located in their own organizational units.

44. Of the 58 central processing units which were available in the organizational units, IBM was still the predominant supplier with 47 per cent. The median primary memory size of computers was between 100 k-bytes and 299 bytes. It exceeded 2 megabytes in respect of 5 of these organizational units as already stated in footnote 12.

45. In respect of computer ownership, 31 were owned against 10 which were rented: however there were 14 computers for which the type of tenure was not indicated. Of all computers reported 52 per cent were less than 5 years aged.

VIII. CONCLUSION

46. Most of African countries are provided with EDP facilities which are used, among other things, to perform government statistical work. However computer time is usually spent on non-statistical rather than statistical work. There is a tendency to acquire more powerful equipment. Generally EDP organizational units prefer to own rather than rent their equipment. The demand for systems and programming staff in the region is confirmed by the recruitment and training plans. Most of EDP training is conducted in-service or at centres provided by EDP suppliers, or at the commercial organizations within the country. Down time condition and provision of repair service seem to be the most important consideration of users in respect of all makes of equipment.

47. There is a need to strengthen co-operation in the area of electronic data processing among countries of the region in order to disseminate quickly comprehensive and up-to-date information to users. In particular, the appointment at ECA of an EDP regional adviser proficient in statistical data base management systems in addition to the one already attached to the Regional Advisory Services of Demographic Statistics will be of assistance to the region.

48. In spite of all the efforts made in undertaking the surveys on data processing capabilities in Africa, the responses rate continues to remain low. It is thus difficult to have an accurate picture of the existing situation. It is therefore desirable that the countries themselves undertake, first, the review of data processing capabilities at national level. ECA Statistics Division might then summarize easily the EDP situation in member countries. Given the increasing number of organizational units using EDP facilities in the region, the limitation of the directory of EDP centres to those which perform government statistical work or have a computer powerful enough (the lower bound of the primary memory size is to be agreed upon) may be more efficient.